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(54) Maintenance of image forming apparatus

(57) In an image forming apparatus, a maintenance period of each of a number of replaceable parts is indicated by storing a predetermined number of maximum times of use of the part in a memory; detecting each use of the part; counting the number of such uses and storing the counted number of times of use in a memory; comparing the counted number of times of use with the predetermined number of maximum times of use; and outputting an indication of the maintenance period in dependence upon the result of the comparison. In this way, a user can be kept accurately informed of the need to replace or clean the replaceable parts.

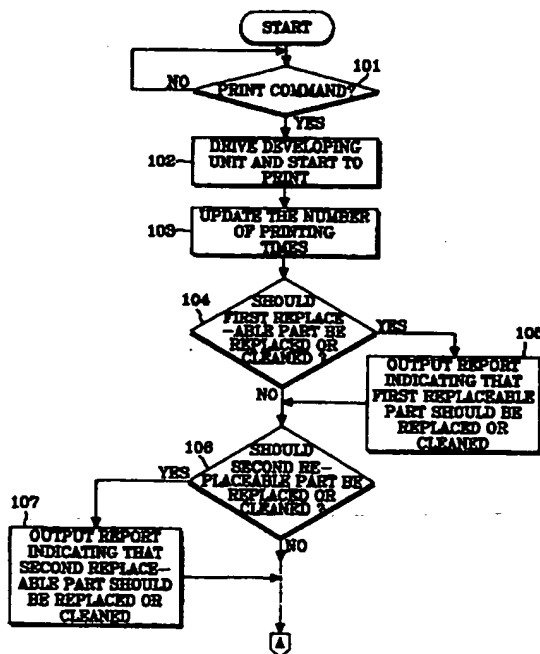
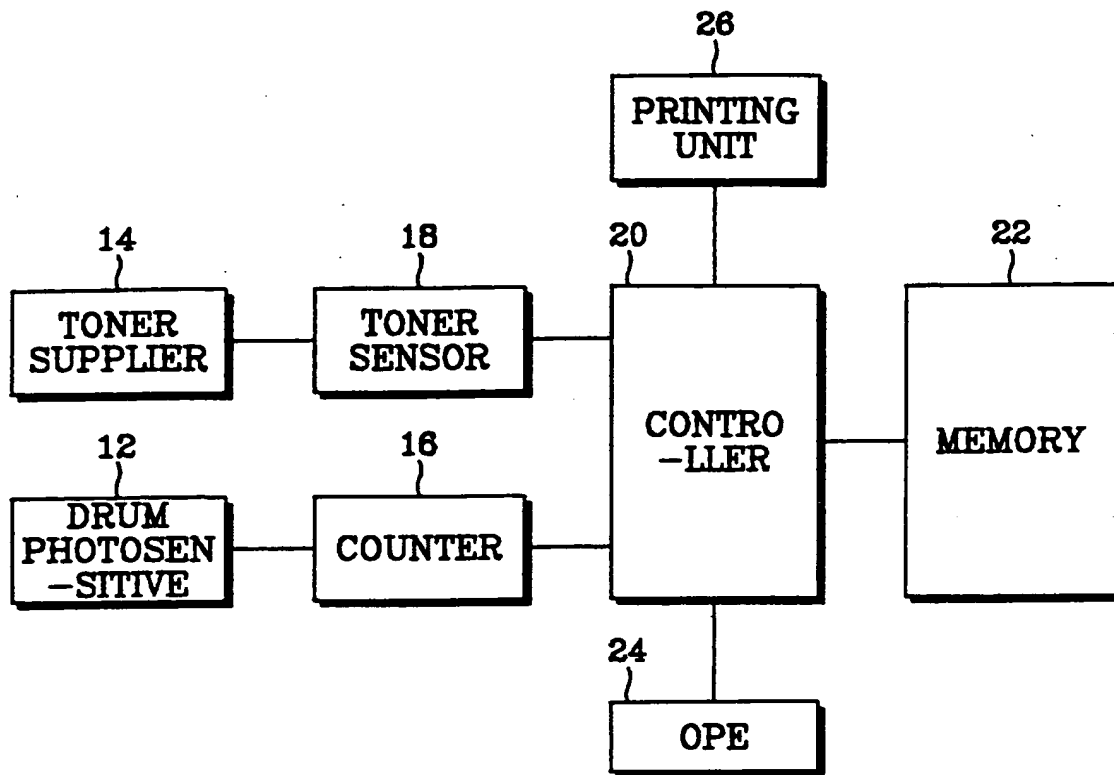
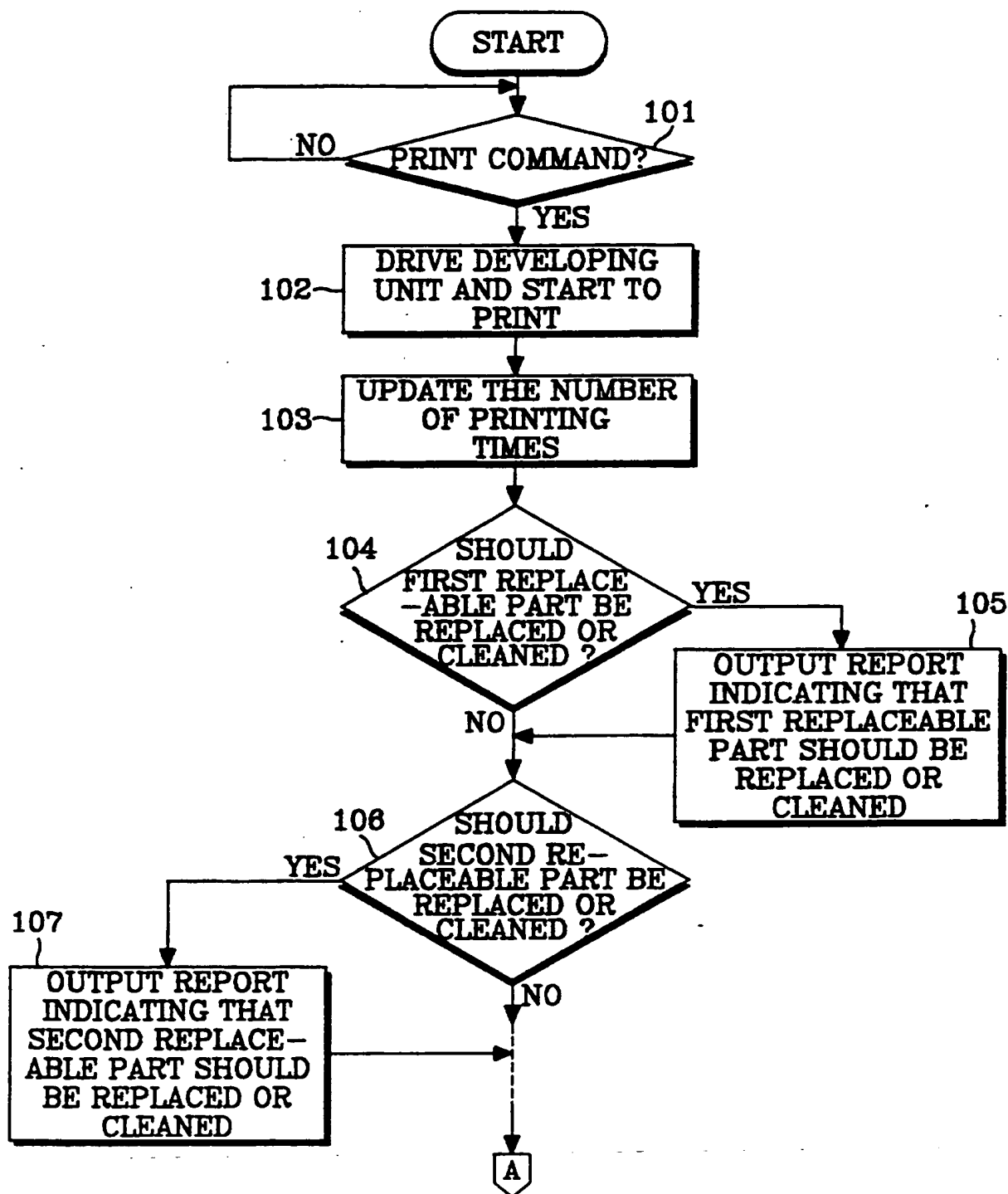
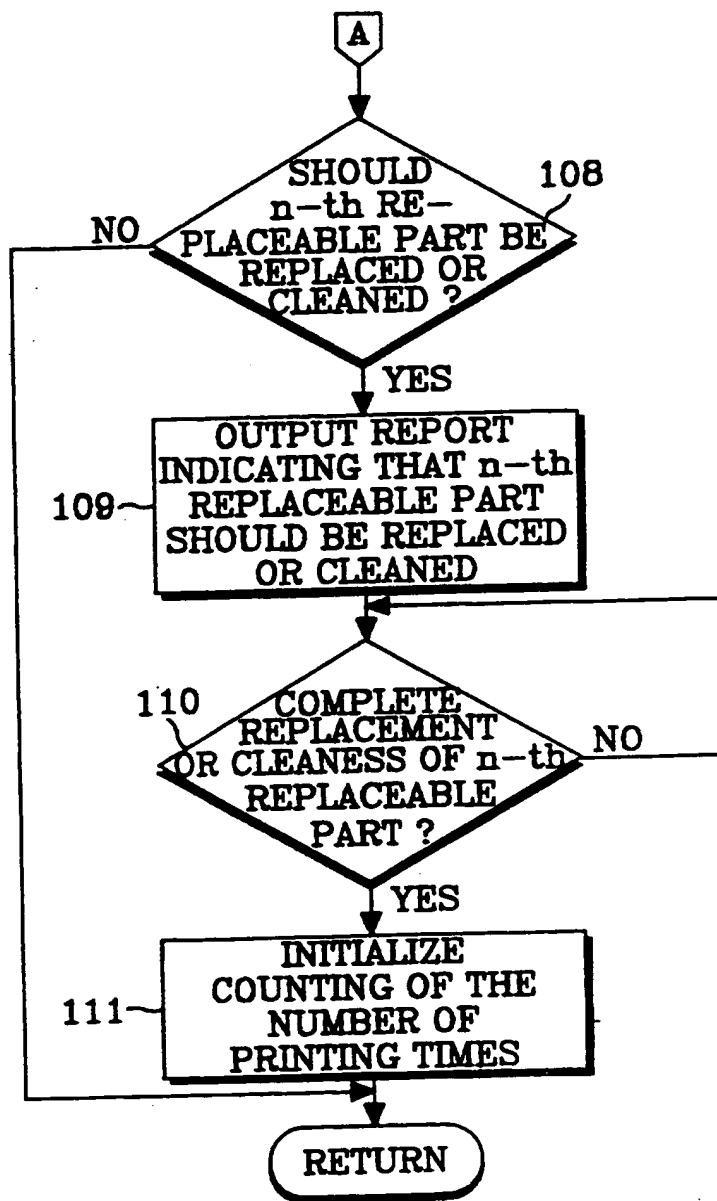


Fig. 2

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*Fig. 1*

*Fig. 2*

*Fig. 2*

MAINTENANCE OF IMAGE FORMING APPARATUS

The present invention relates to maintenance of image forming apparatus.

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In image forming apparatuses, in order to ensure continuous high quality printing, it is highly recommended that certain parts within the apparatus be replaced after a prescribed amount of use. That is, to ensure high quality printing in a LBP (Laser Beam Printer), LED (Light Emitting Diode) printer, duplicator, facsimile, etc., parts such as a photosensitive drum, toner receptacle, etc. should be replaced after the printing output of the apparatus reaches a prescribed quantity. There are typically several replaceable parts within an image forming apparatus, including the photosensitive drum, developing unit, etc. Timely replacement of these parts improves copy quality and visibility, and also lengthens the operating life of the apparatus.

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In conventional image forming apparatus, however, it is difficult for a user to know the number of printing copies, and since the maintenance periods of respective replaceable parts are different from each other, the user can not readily execute a timely replacement. From this, there arises a problem in that the image quality may deteriorate and the operating life of each part within the image forming apparatus may be reduced.

Preferred embodiments of the present invention aim to provide an improved method for detecting accurately a predetermined maintenance period of replaceable parts and informing a user of an optimal maintenance period.

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It is another aim to provide a method for recording the number of times of use of replaceable parts by installing a memory storing information of a replacement period of the replaceable parts within an image forming apparatus  
5 and warning a user to replace the replaceable parts.

It is still another aim to provide a method of outputting automatically a report indicating a maintenance period of replaceable parts by sensing use status of those parts  
10 which have a predetermined number of times of use.

According to one aspect of the present invention, there is provided a method of indicating a maintenance period of a replaceable part within an image forming apparatus,  
15 comprising the steps of:

storing a predetermined number of maximum times of use of said replaceable part in a memory;

20 detecting each use of said replaceable part, counting the number of said uses and storing the counted number of times of use in a memory;

comparing said counted number of times of use with said  
25 predetermined number of maximum times of use; and

outputting an indication of said maintenance period in dependence upon the result of said comparison.

30 Preferably, said indication comprises printing or displaying a report.

Preferably, said report indicates a maintenance status of said part.

Preferably, said report is printed when said maintenance period expires, upon said counted number of times of use equalling or exceeding said predetermined number of maximum times of use.

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Said indication may comprise a visible and/or audible warning which is generated when said maintenance period expires, upon said counted number of times of use equalling or exceeding said predetermined number of maximum times of use.

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A method as above may indicate a maintenance period of each of a plurality of said replaceable parts within said image forming apparatus.

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Different ones of said plurality of said replaceable parts may have different respective maintenance periods.

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Preferably, said replaceable parts comprise at least a photosensitive drum and developing unit.

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Preferably, each image forming operation of the image forming apparatus is counted as one time of use of the or each said replaceable part.

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According to another aspect of the present invention, there is provided an image forming apparatus arranged to perform a method according to any of the preceding aspects of the invention.

Such an image forming apparatus may comprise a printer or facsimile machine.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

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Figure 1 is a block diagram illustrating one example of an image forming apparatus according to the present invention; and

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Figure 2 is a flow chart illustrating control operations for outputting a report indicating a maintenance period of replaceable parts according to one example of the present invention.

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The image forming apparatus shown in Figure 1 comprises: a photosensitive drum 12; a toner supplier 14 for supplying toner to the photosensitive drum 12; a toner sensor 18 for detecting the amount of toner remaining in toner supplier 14; a counter 16 for counting a number of printing operations; and a controller 20 for comparing a value of the number of printing operations output from the counter 16 with a value of a number of predetermined times of use and, when the value of the number of printing operations exceeds the value of the number of predetermined times of use, displaying a message indicating a maintenance period of replaceable parts, i.e. a time for replacement or cleaning the replaceable parts, or outputting a report indicating the maintenance period of the replaceable parts. A memory 22 is connected to the controller 20, for storing a program informing a user of the maintenance period of the replaceable parts and a value of the number of predetermined times of use for each part; an operation panel equipment (hereinafter OPE) 24 having manual keys, numeric keys, and various kinds of

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function keys, for displaying a message indicating the maintenance period of the replaceable parts under control of the controller 20; and a printing unit 26 for printing a report indicating the maintenance period of the replaceable parts under control of the controller 20.

In the above construction of Figure 1, the controller 20 counts the number of printing operations, compares the counted number of printing operations with the number of predetermined times of use of the replaceable parts and outputs a message corresponding to the compared result.

Figure 2 is a flow chart illustrating control operations for outputting a report indicating the maintenance period of replaceable parts according to an example of the present invention. The control operations comprise the steps of detecting the number of times of use of replaceable parts and updating the detected number of times of use of replaceable parts to a memory, comparing the updated data of the number of times of use with data of a number of predetermined times of use stored in the memory to detect a maintenance period of each of the replaceable parts, and outputting a report indicating the maintenance period of each of the replaceable parts.

A more detailed description of this example of operation will be made with reference to Figures 1 and 2.

When manufacturing the image forming apparatus, the number of predetermined times of use for each of the replaceable parts is stored to the memory 22. In step 101, the controller 20 detects whether a print command is input from the OPE 24 in the case of a laser printer, or whether the print command is input by receiving a copying key or

image data from the OPE 24 in the case of a plain paper facsimile. If the print command has been input, it proceeds to step 102. The controller 20 drives the photosensitive drum 12 and a developing unit and then prints the image data through the printing unit 26. At this time, the counter 16 applies the number of printing operations to the controller 20. Then, in step 103, the controller 20 detects the number of printing operations and stores it to the memory 22. Whenever the number of printing operations increases, the controller 20 continuously updates it. In step 104, the controller 20 detects whether a first replaceable part reaches its maintenance period, i.e. the period when the first replaceable part should be replaced or cleaned, and if the first replaceable part should be replaced or cleaned, advances to step 105 to drive the printing unit 26 and to output a report indicating that the first replaceable part should be replaced or cleaned. In the step 104, however, if the first replaceable part has not reached its maintenance period, the control procedure advances to step 106 and detects whether a second replaceable part reaches its maintenance period, and if the second replaceable part should be replaced or cleaned, advances to step 107 to drive the printing unit 26 and to output a report indicating that the second replaceable part should be replaced or cleaned. In the step 106, however, if the second replaceable part has not reached its maintenance period, the procedure advances to step 108 and detects whether an n-th replaceable part reaches the maintenance period, and if the n-th replaceable part should be replaced or cleaned, advances to step 109 to drive the printing unit 26 and to output a report indicating that the n-th replaceable part should be replaced or cleaned.

In steps 104 to 109, when various kinds of replaceable parts are provided, if their operational life-times are different from each other, each life-time of the replaceable parts is compared with the number of predetermined times of use stored in the memory 22. As a result, when each of the replaceable parts reaches its number of predetermined times, the controller 20 outputs a report indicating that the replaceable part should be replaced or cleaned.

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When the number of printing operations has reached a number of predetermined times of use, the controller 20 detects the state in the above steps 104, 106 and 108. For instance, if the number of printing operations of the photosensitive drum 12 is greater than or equal to the number of predetermined times of use thereof, the controller 20 detects this state in the step 104. Then, the controller 20 outputs the report indicating that the replaceable part (i.e. the photosensitive drum 12) should be replaced through the printing unit 26, so that the photosensitive drum 12 can be replaced with a new drum.

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In step 110, the controller 20 detects whether the replacement or cleanness of the n-th replaceable part has been completed, and if completed, proceeds to step 111 to initialize the counter 16 and return to a general operation of the apparatus.

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In the preferred embodiment of the present invention, the report indicating that a corresponding replaceable part should be replaced or cleaned is printed, but a warning unit connected to the controller 20 and for generating an audible signal using a sound generator (not shown) may be presented in order to inform a user of the maintenance

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period of the replaceable parts, without departing from the true scope of the present invention.

5 The above-described example of the present invention provides a method for detecting accurately a predetermined maintenance period of replaceable parts and informing a user of an optimal maintenance period, and a further method of outputting automatically a report indicating a maintenance period of replaceable parts by sensing used  
10 status of these parts which have a number of predetermined times of use, so that the image quality can be improved and the management of each part within the image forming apparatus is accurately achieved.

15 While there have been illustrated and described what are considered to be preferred embodiments of the present invention, it will be understood by those skilled in the art that various changes and modifications may be made, and equivalents may be substituted for elements thereof  
20 without departing from the true scope of the present invention. In addition, many modifications may be made to adapt a particular situation to the teaching of the present invention without departing from the central scope thereof. Therefore, it is intended that the present  
25 invention not be limited to the particular embodiments disclosed as the best mode contemplated for carrying out the present invention.

30 The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

**CLAIMS:**

1. A method of indicating a maintenance period of a replaceable part within an image forming apparatus,  
5 comprising the steps of:

storing a predetermined number of maximum times of use of said replaceable part in a memory;

- 10 detecting each use of said replaceable part, counting the number of said uses and storing the counted number of times of use in a memory;

- 15 comparing said counted number of times of use with said predetermined number of maximum times of use; and

outputting an indication of said maintenance period in dependence upon the result of said comparison.

- 20 2. A method according to claim 1, wherein said indication comprises printing or displaying a report.

- 25 3. A method according to claim 2, wherein said report indicates a maintenance status of said part.

- 30 4. A method according to claim 2 or 3, wherein said report is printed when said maintenance period expires, upon said counted number of times of use equalling or exceeding said predetermined number of maximum times of use.

5. A method according to any of the preceding claims, wherein said indication comprises a visible and/or audible warning which is generated when said maintenance period

expires, upon said counted number of times of use equalling or exceeding said predetermined number of maximum times of use.

- 5     5.    A method according to any of the preceding claims, for indicating a maintenance period of each of a plurality of said replaceable parts within said image forming apparatus.
- 10    6.    A method according to claim 5, wherein different ones of said plurality of said replaceable parts have different respective maintenance periods.
- 15    7.    A method according to claim 5 or 6, wherein said replaceable parts comprise at least a photosensitive drum and developing unit.
- 20    8.    A method according to any of the preceding claims, wherein each image forming operation of the image forming apparatus is counted as one time of use of the or each said replaceable part.
- 25    9.    A method of indicating a maintenance period of a replaceable part within an image forming apparatus, the method being substantially as hereinbefore described with reference to the accompanying drawings.
- 30    10.   An image forming apparatus arranged to perform a method according to any of the preceding claims.
11.   An image forming apparatus according to claim 10, comprising a printer or facsimile machine.



Application No: GB 9611275.0  
Claims searched: 1-11

Examiner: Mike Davis  
Date of search: 17 July 1996

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4H (HGN,HQE,HQ2), B6C (CVE,CVG), B6F (FMB), H4F (FFX)

Int Cl (Ed.6): G03G, B41J, B41L, H04N

Other: Online: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X,P	EP 0685768 A1 (XEROX)	1 at least
X,P	EP 0672972 A2 (MITA)	.
X	EP 0505946 A2 (TOKYO ELECTRIC)	.
X	EP 0395320 A1 (XEROX)	.
X	EP 0393627 A2 (TOKYO ELECTRIC)	.
X	US 5333960 (NAM)	.

*The citations are examples only.*

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.